CNS/ATM for Naval Aviation

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Purpose

This newsletter provides information to the Naval aviation community on civil initiatives in Communications, Navigation and Surveillance / Air Traffic Management (CNS/ATM).

ATM

Air Traffic Management

The focus of your Navy CNS/ATM team is on the avionics changes that provide functionality to meet civil requirements. However, an understanding of the changes that are occurring in Air Traffic Control (ATC) as it migrates to Air Traffic Management (ATM) is also required.

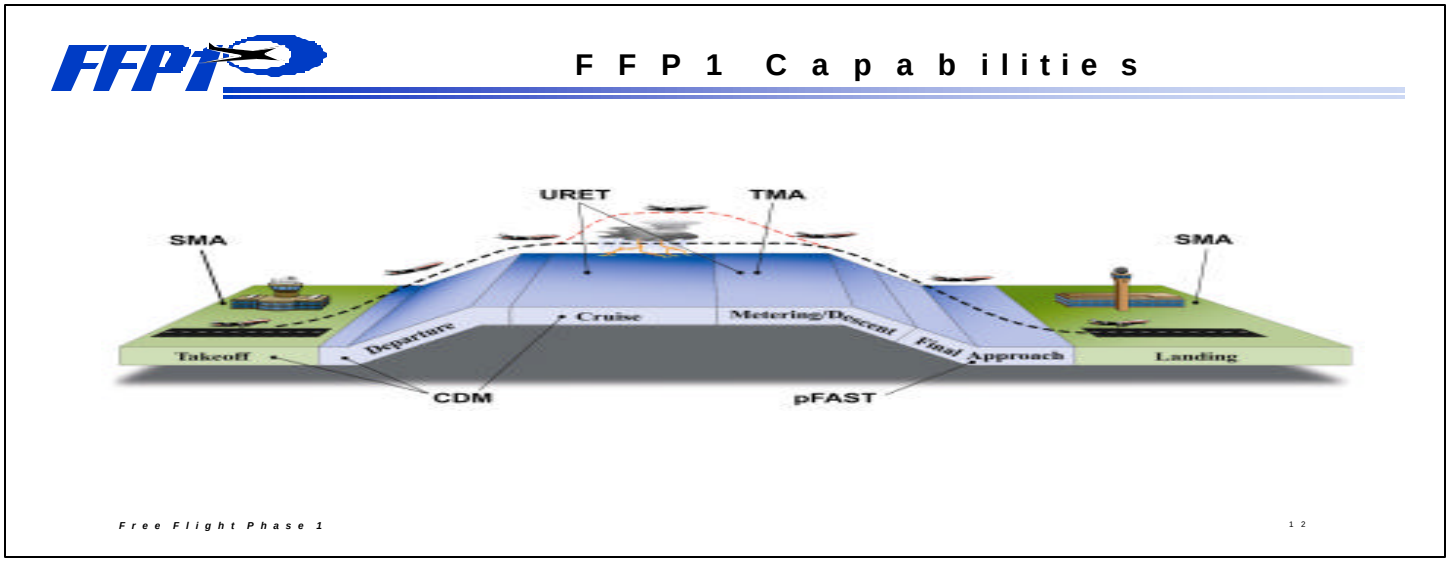
The ATC infrastructure needs to evolve to keep pace with the explosive growth in passenger traffic. For example, the FAA forecasts an average US growth of 500,000 passengers *per week every week* over the next ten years. Proposed CNS/ATM airspace functionalities can easily accommodate the expected global increase of over 8000 commercial aircraft hulls. Similarly, proposed changes in the functions of the ATC are essential to maintain the safety of the airspace architecture.

Analyzing the current airspace architecture, designers identified several potential bottlenecks. The lack of concrete, in the form of runways, taxiways, and airports, can be overcome in time. Using modern avionics, platform technical deficiencies can also be overcome. ATC, on the other hand, required a complete overhaul. Hiring additional controllers and redefining the sectors does not address the basic problem of imbalances in traffic flow. Only by changing the responsibilities of the controller could the problem be alleviated. Note that controller as used here includes both tower and en-route ATC responsibilities.

Further analysis of ATC showed additional issues. While adjacent controllers coordinated smooth traffic flows, a national traffic flow manager was necessary to smooth out imbalances caused by weather, traffic density, and equipment outages. Reducing controller current workload was central to handling increases in traffic. Changes such as free flight, automatic dependent surveillance, and controller to pilot data links would impact the workload.

The FAA, under the Free Flight Phase 1 program, is developing five tools for controller use to relieve some workload. One tool is Surface Movement Advisor (SMA). SMA utilizes real time aircraft position radar data to predict aircraft arrival time. SMA allows users to efficiently coordinate the management of ground support services.

The User Request Evaluation Tool (URET) has three capabilities. URET allows the controller to detect conflicts between aircraft and detect conflicts between an aircraft and special use airspace. URET evaluates requests for changes in the flight plan or proposed route changes for conflicts.



Using a visual display of the problem and the URET's trial planning function, a controller can determine the most appropriate conflict-free flight trajectory.

Another tool being developed is the Traffic Management Advisor (TMA). Based upon traffic flow constraints, TMA develops an arrival-scheduling plan. TMA then computes and assigns scheduled times of arrival at meter fixes, final approach fixes, and runway thresholds. It also assigns aircraft to runways. TMA optimizes available capacity at an airport.

Also under development is the Passive Final Approach Spacing Tool (pFAST). pFAST generates a list of landing sequence numbers and runway assignments for arriving aircraft. This allows for higher efficient use of runways during peak traffic periods. pFAST, using flight data, track information, and controller inputs, calculates a set of routes from an aircraft's current position to all possible runways. These four dimensional trajectories for each route are refined taking into account current atmospheric conditions and aircraft operating characteristics. pFAST uses the trajectories for computed runway assignments. A timeline view aids controllers in integrating arrival and departure operations.

The last tool being developed is the Collaborative Decision Making (CDM) with Airline Operations Centers (AOC) tool. CDM is a major step from ATC toward ATM. Easily the most complex tool, CDM uses web-based technology to collect and distribute status information on the National Airspace System (NAS). The status information includes airspace status such as special use airspace schedules, miles in trail restrictions, and arrival delay advisories. It also includes airport status information such as projected demand and capacity, acceptance rates and departure delays, runway visual range, and actual pushback times.

Using the available data, each user develops a common view of the NAS. This enhances situational awareness and promotes cooperation in solving problems. Each user "pulls" information as opposed to "push" or automatic delivery. Users outside the FAA receive the data over proprietary or private networks.

During periods of constrained traffic flow, for example, due to severe weather, the ATM, using CDM display conferencing capabilities, discusses the constraints with all affected AOCs. All participants view the "electronic chalkboard" simultaneously using voice to discuss solutions. Most participants can draw on the overlay with all parties viewing the changes. The benefits are quicker decision making and a common ATC / user understanding of solutions.

Once a consensus approach is reached, all participants benefit. The ATM is confident that the most efficient traffic flow achievable in the NAS is being implemented. AOCs benefit by choosing the best combination of actions, which causes the least ripples in their scheduled operations. For example, an AOC may select the Ground Delay Program for flights where gate occupancy is not critical. It could select Severe Weather Avoidance Program (SWAP) routes for other flights. In this way, overall hub and spoke operations could be time shifted for the least passenger inconvenience.

By the end of 2002, a limited number of sites will be testing combinations of the controller tools. One site is the NAS Traffic Manager in Herndon, VA. As the infrastructure develops, more sites will come on line.

After 2015 with continued development of the tools and implementation of the Aeronautical Telecommunications Network, it is easy to envision an advanced ATM system. AOC's load in flight schedules and preliminary flight plans electronically. The plans are analyzed and conflicts are detected before the first passenger boards the flight. Flight plan changes, due to weather or the sudden availability of airspace, are dynamically analyzed with subsequent uploads of revised flight plans. Tower controllers, armed with new tools, choreograph the ballet of the tarmac for efficient ground operations. En-route controllers safely coordinate the passage of aircraft under free flight rules. The national traffic flow manager, in collaboration with AOCs, minimizes NAS delays due to any cause. Airline AOCs more efficiently managed their fleets and schedules when faced with non-routine conditions. Ground support activities, due to increased information, provide aircraft and passengers with more efficient services. Due to increased efficiencies, both airlines and ground support services become more profitable. The ATM system handles substantially increased traffic with very little increase in the number of controllers.

CNS/ATM NEWS

8.33kHz Channel Spacing Implementation

On 7 October 1999, 8.33 kHz VHF channel spacing was required in the airspace of Austria, Belgium, France, Germany, Luxembourg, the Netherlands, and Switzerland above FL245. The United Kingdom delayed implementation. It was expected that implementation would start in July 2000. The United Kingdom will implement 8.33kHz VHF channel spacing on 1 January 2002.

Military aircraft equipped with UHF radios are generally exempt from 8.33 kHz operations. However, there are sectors in Austria and Switzerland where UHF is not available. In those sectors, aircraft not equipped with 8.33 kHz VHF channel spacing are not permitted. For safety considerations, all aircraft should be 8.33 kHz equipped.